MICE Muon Beam:

Conventional Magnet Power Supplies – Operating Instructions

Preconditions:

1. Method statement and risk assessment agreed by Hall Manager/Principal Contractor[1] and/or MOM[2]. **Authorisation to work obtained**;
2. Keys to magnet power supplies that will be operated obtained from MICE Hall Manager/Principal Contractor or MOM;
3. Area around magnet power supplies and magnets appropriately signed and fenced off;
4. Magnet Control PC in MICE Local Control Room must be booted up. (User ID/password available on the MICO Passwords page);
5. Magnet check list must be completed, see below.

Magnet power supply operating instructions

Powering up:

1. Turn on Q4, Q5, Q6, Q7, Q8, Q9, D1, and D2 power supplies.
   i. Remove padlock from power supply breaker and turn supply on; see **Appendix 1** for locations of the power supplies (a convenient place to store the lock while it is not in use is on top of the supply rack);
   ii. Twist 'Emergency Off' button so that button springs out into 'enable' position;
   iv. Using power-supply controls:
      a. If interlock warning LED is lit, identify and reset any interlock warnings;
         - Select 'Intl';
      b. Select 'Internal' and 'External' and record interlock condition. Press 'Reset'. If this does not clear interlock alarm, contact MOM;
      c. Once interlocks cleared, proceed to 1.v.
   v. Set power supply to remote control:
      a. Select 'CMD';
      b. Select 'REM'.
2. Turn on Q1, Q2, and Q3; see **Appendix 1** for locations of the power supplies. The power supplies for Q1, Q2, and Q3 are different from the others. They are grouped together in one rack. There are 4 orange clips holding breaker switches off at the bottom of the rack in a column of switches. It is important to remember where the orange clips are located and only turn those switches off after running.
   i. Remove padlock from orange clips in column of switches on right side at bottom of rack.
   ii. Note positions of 4 orange clips and remove them. Place clips and padlock on top of power supply to the left of the rack.

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iii. Flip 4 switches at bottom of rack to ON position.

iv. On each individual power supply, there are an additional 3 switches oriented horizontally. Flip these up into the ON position.

v. Twist the 'Emergency Off' red button located above the three power supplies so that it springs out into the 'enable' position. Push the green reset button.

vi. Using power-supply controls:

a. If interlock warning LED is lit, identify and reset any interlock warnings;

- Select 'Intl';

b. Select 'Internal' and 'External' and record interlock condition. Press 'Reset'. If this does not clear interlock alarm, contact MOM;

c. Once interlocks cleared, proceed to 2.vii.

vii. Set power supply to remote control:

a. Select 'CMD';

b. Select 'REM'.

3. From the Application Launcher on the Magnet Control PC in the MLCR:

i. From the main menu panel click: "Magnet Power Supplies";

ii. Either select the power supply you want to operate, or select 'All'.
A panel will appear with the name of the power supply at the top (or, if 'All' was selected, a list of all magnets). See **Appendix 2** if the panel is in black/white and not operational. This panel contains "Status" and "Control" boxes.
The control box lets you control the supply. The status box:

- Tells you the current and voltage for the power supply;
- The green "LED" will be bright if the power is on;
- The red "LED" will be bright if any interlocks are tripped.

iii. To turn the supply on or off select the "Power" button. To turn on the power supply select 'On'; to turn it off, click 'Off';

iv. To set the current, type a number into the blue "Output Current" box and hit 'Enter' or 'Return'.

v. NOTE: Ramp magnets up slowly – 25A/minute for Q1,Q2,Q3 and D2, 50A/minute for the others.

5. If the supply has tripped click the brown "Status" button at the bottom. This will bring up a larger panel showing all the status information. The red "LEDs" on the left show the current state of the latched interlocks.
The yellow "LEDs" show the state at the time the trip occurred.

- Click the blue "Reset" button to reset the interlocks.

Turning off:

1. Gradually reduce the current to '0' using the control programme on the Magnet Control PC;

i. NOTE: Ramp magnets down slowly – 25A/minute for Q1,Q2,Q3 and D2, 50A/minute for all others.

2. Turn the power supply off at the Magnet Control PC;
3. Go to the power supply in the MICE Hall and for Q4-9, D1 and D2:

i. Set the power supply to 'Local':

a. Select 'CMD', then 'Local';

ii. Press the 'Emergency off' button;

iii. Set the circuit breaker to OFF;

iv. Lock the circuit breaker in the OFF position.

3. Again, the power supplies for Q1, Q2, and Q3 are different from the others. It is important to remember where the orange clips are located and only turn those switches off after running.
   i. Set the power supply to 'Local' for each of the three supplies in the rack:
      a. Select 'CMD', then 'Local';
   ii. Press the 'Emergency off' button located above the three power supplies;
   iii. Flip the 3 horizontal switches located on each power supply down to the OFF position.
   iv. On the column of switches at the bottom of the rack, on the right side, working from the top down, flip ONLY the first 3 switches and the 5th switch (from the top) to the OFF position.
   NOTE: DO NOT turn off the switch labelled VME crate!
   v. Replace the orange clips in these 4 switches.
   vi. Put padlock through first 3 clips and lock.
4. Return the magnet-power-supply key to the MICE Hall Manager/Principal Contractor or MOM.

Completing magnet power supply check list

1. Obtain magnet check list from folder in MLCR, fill in name, name of MOM, date, and time;
2. Strike out magnets that will not be used;
3. Check water flow to magnet is greater than minimum:
   i. Compare meter readings to the reference values given on the magnet check list. These values are handbook minima for the flow through Q1 – Q3, D1 and D2, and measured minima for Q4 – Q9. It is necessary to do this manually at the location of the meters in the Hall. See Appendix 3 for the locations of the flow meters;
4. Check that the water flow to the magnet power supplies is within set limits.
   i. The power supply water flow monitoring gauges are located on the North wall of the trench beginning at the eastern-most end of the trench. Check to make sure that the orange float is between the two orange limits on the tube for each magnet power supply.
4. If changes have been made recently, then the magnet power-supply polarity (MGT/PS polarity) must be checked at the back of the power supply. Ask the MOM about recent beamline configurations.
   i. With power supply OFF, open the back of the power supply. The wiring convention is:
      - For positive particles, the positive lead should be connected to the positive terminal and the negative lead to the negative terminal;
      - For negative particles, the negative lead should be connected to the positive terminal and the positive lead to the negative terminal.

      See MICE Note 198 for further details;
5. Check that all interlocks on the power supply are cleared (PS Interlocks column on check list). Instructions to clear interlocks are given above. If the water-flow interlock on, it may be necessary to adjust the water flow manually, contact the MOM;
6. Check that the control from the Magnet Control PC in the MLCR is available (MLCR CTRL on the check list);
7. Finally, if all magnet conditions are 'OK' tick the magnet OK box on the check list.

Appendix 1 – Location of the power supplies in the MICE Hall

Q1,2,3 in a single rack behind the staircase to the second floor, North-East corner.

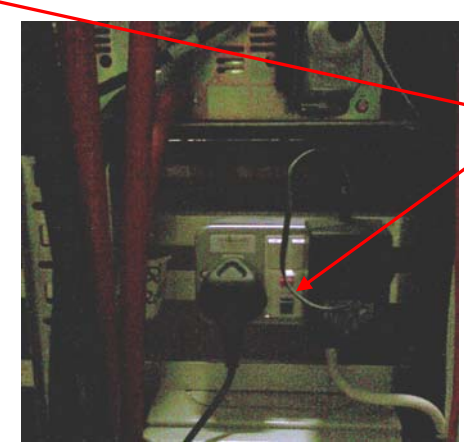
Rack with **Q1,2,3** power supplies and **remote control**

(Note that the orange locking tabs must be removed in order to turn on the supplies.)

D1,2 and Q4-9 along the North wall of the MICE Hall

Appendix 2: Problems with the remote control from the PC miceopi1

Check the status of the remote control unit and its communication with the PC miceopi1:
locate the remote control unit in the rack with power supplies for Q1,2,3, (see Appendix 1)
open its rear door (key available in the key press at the North-West corner of the hall) and locate the communication unit (see photo). The LEDs should blink indicating data transfer. If not, reset the power of the unit by pressing the red and then the black buttons on the power socket (see photo)
the two red LED on the front panel should blink. If not, reset the unit by switching OFF/ON.



The communications computer in the power-supply rack may also need to be initialised. To do this, start a Terminal window on the MICECON1 PC in the MICE LCR and type the following:
telnet micets4 7001<return>
<return>
Ctrl-x
after which VxWorks will boot on the remote computer and issue many messages, which may be ignored and the Terminal window closed.

Appendix 3 – Location of water flow meters for magnets & power supplies.

System	Location	Reference flow rate	Photo	Comment
D1, Q1-3 Mgts	Within cage entrance to DSA	D1 > 22 l/m Q1,2,3 > 25 l/m		If flow too low contact J.Govans, extn 1804 or from ISIS MCR
D2, Q4-9 Mgts	In 2 boxes in the water trench, opposite to entry staircase	D2 > 22 l/m Q4,5,6 > 23 l/m Q7,8,9 > 23 l/m		If flow too low, adjust yellow levers on both flow & return (see on both photos)

All power supplies	In the water trench, at far end near the synchrotron wall and around the entry staircase	Flow-meters between the marks		If flow too low, check yellow/red valve open. Also check disc valve open.